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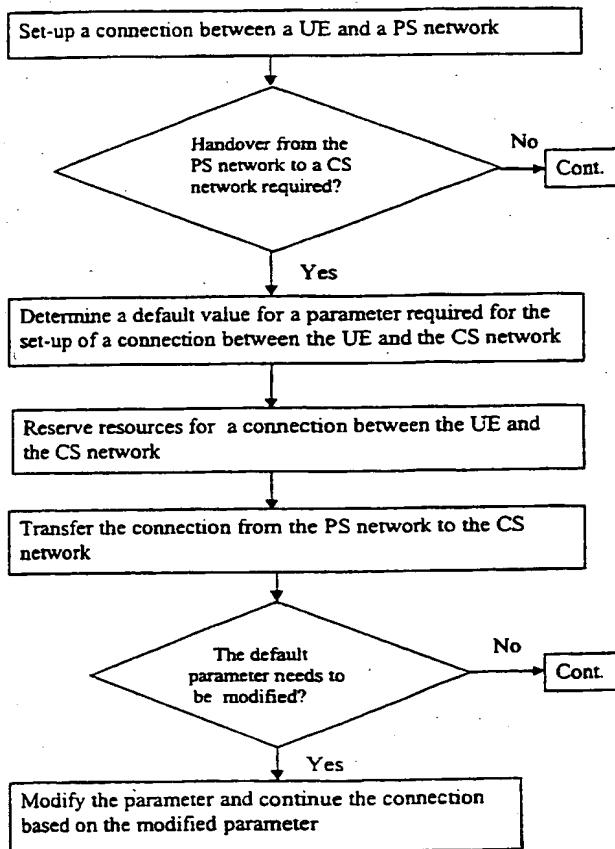
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(54) Title: INTERSYSTEM HANDOVER WITH MODIFIED PARAMETERS



(57) Abstract: A method for a communication system that includes a first node, a second node and a third node. In the method a connection is established between the first node and the second node based on predefined parameters. Handover of the connection is initiated so that the connection may continue between the first node and the third node. A default value is used for at least one connection parameter required for said connection between the first node and the third node. If it is determined as necessary, the value of said at least one parameter is then modified after the connection has been established.

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INTERSYSTEM HANDOVER WITH MODIFIED PARAMETERS

Field of the Invention

5 The present invention relates to handover in a communication system, and in particular, but not exclusively, to handover of a connection from a node to another node, wherein the other node requires at least one parameter for the connection that is not employed by the previous node.

10

Background of the Invention

Communication networks typically operate in accordance with a given standard or specification which sets out what the various elements of the network are permitted to do and how that should be achieved. For example, the standard may define whether the user or more precisely, user equipment is provided with a circuit switched service or a packet switched service. The standard may also define the communication protocols which shall be used for the connection. The given standard also defines one or more of the required connection parameters. The connection parameters may relate to various features of the connection. The parameters may define features such as the maximum number of traffic channels, quality of service and so on or features that relate to multislot transmission.

In other words, the standard defines the "rules" and parameters on which the communication within the communication system can be based on. Examples of the different standards and/or specifications include, without limiting to these, specifications such as GSM (Global System

for Mobile communications) or various GSM based systems (such as GPRS: General Packet Radio Service), AMPS (American Mobile Phone System), DAMPS (Digital AMPS), WCDMA (Wideband Code Division Multiple Access) or CDMA in UMTS (Code Division 5 Multiple Access in Universal Mobile Telecommunications System) and so on.

The user equipment i.e. a terminal that is to be used for communication over a particular communication network has to 10 be implemented in accordance with the predefined "rules" of the network. A terminal may also be arranged to be compatible with more than one standard or specification, i.e. the terminal may communicate in accordance with several different types of communication services. These user equipment are 15 often called as multi-mode terminals, the basic example thereof being a dual-mode mobile station.

A communication network is a cellular radio network consisting of cells. In most cases the cell can be defined as 20 a certain area covered by one or several base transceiver stations (BTS) serving user equipment (UE), such as mobile stations (MS), via a radio interface and possibly connected to a base station subsystem (BSS). Several cells cover a larger area, and form typically a radio coverage area 25 referred to as a location area (LA) or in some standards as a routing area (RA). It should be appreciated that the size of the location area or routing area depends on the system and circumstances, and may equal to one cell or be even smaller, such a part of a coverage area of a base station. A feature 30 of the cellular system is that it provides mobility for the mobile stations, i.e. the mobile stations are enabled to move from a location area to another, and even from a network to

another network that is compatible with the standard the mobile station is adapted to.

The user equipment (UE) within one of the cells of the 5 cellular system can be controlled by a node providing controller function. Examples of the controller nodes include a base station controller (BSC), a radio network controller (RNC) and a mobile switching center (MSC), but other control nodes may also be implemented in the network. For example, in 10 the circuit switched GSM (Global System for Mobile) network the controller node is provided by means of a mobile switching center (MSC). In the packet switched UMTS the radio access network thereof is controlled by a radio network controller (RNC). The controller can be connected further to 15 a gateway or linking node, for example a gateway GPRS support node (GGSN) or gateway mobile switching center (GMSC), linking the controller nodes to other parts of the communication system and/or to other communication networks, such as to a PSTN (Public Switched Telecommunications 20 Network) or to a data network, such as to a X.25 based network or to a TCP/IP (Transmission Control Protocol/Internet Protocol) based network. The network may also include nodes for storing information of mobile stations subscribing the networks or visiting the networks, such as 25 appropriate home location registers (HLR) and visitor location registers (VLR).

When user equipment communicates with a communication network, a communication path has been established between 30 the user equipment and an element or node of the network. The network node is typically one of the controller nodes. At least a part of the communication between the user equipment

and the actual destination node will then pass through the controller node.

It is possible to transfer i.e. to handover the connection
5 from a first node to a second node. This shall also be
possible between two nodes that belong to different network
systems. For example, a user equipment having a packet
switched (PS) connection with a packet switched network
system (e.g. the UMTS) may be handed over to have a circuit
10 switched (CS) connection with a circuit switched network
system (e.g. the GSM) and vice versa. The handover of the
connection may be required e.g. when the mobile station moves
i.e. roams from a cell to another cell. In case the new cell
is not served by the same system as the previous cell, the
15 handover needs to be accomplished between different
communication systems.

The inventor has found that in situations where a handover is
to be accomplished between the nodes of different
20 communications systems (i.e. systems that are based on
different communication rules), it is possible that the "new"
connection cannot be properly set-up due to a difference in
the parameters required for the connection by the "new" and
the "old" i.e. previous communication systems. An example is
25 a handover from a packet switched connection to a circuit
switched connection or vice versa. A more detailed example is
a handover of a high speed circuit switched data connection
between from UMTS (Universal Mobile Telecommunications
System) to GSM (Global System for Mobile communications). In
30 the GSM the high speed data is enabled by a multislot
mechanism which requires a certain parameter to be exchanged
at the call setup. A corresponding mechanism does not exist

in the UMTS, and consequently corresponding parameters are not generated or exchanged at the UMTS-call setup. After a UMTS to GSM handover the multislot parameters, however, are required in the GSM portion of the call. Although the mobile stations may provide these parameters; the (dual-mode) UMTS mobile stations may not be obliged to send any GSM-specific parameters every time they set-up a UMTS-call, and therefore the parameters may need to be provided in some other manner at the intersystem handover. In addition, the tight timing requirements of handovers may not allow any exchange of parameters that are not used by the connection before or during the handover procedure.

Summary of the Invention

15

It is an aim of the embodiments of the present invention to address one or several of the above problems.

20

According to one aspect of the present invention, there is provided a method in a communication system that includes a first node, a second node and a third node, comprising the steps of:

establishing a connection between the first node and the second node based on predefined parameters;

25

initiating handover procedure of the connection so that the connection may continue between the first node and the third node;

30

using a default value for at least one connection parameter required to establish the connection between the first node and the third node; and

modifying, if determined necessary, the value of said at least one parameter.

According to another aspect of the present invention there is provided a communication system comprising:

a first node, a second node and a third node, wherein
5 the first node may communicate with the second node and the third node and a connection between the first node and the second node can be handed over to a connection between the first node and the third node, the set-up of a connection between the first node and the third node being based on at
10 least one parameter that is different from the parameters required for the set-up of the connection between the first node and the second node;

a controller for determining a default value for said at least one different parameter to be used for setting up the
15 connection between the first node and the third node after the handover procedures have been initiated; and

means for modifying the value of said at least one parameter.

20 The embodiments of the invention may provide a handover procedure of a communication connection from a first node to a second node of a communication system even in instances where the second node cannot base the connection on one or more of the connection parameters used by the first node for
25 the connection. The further embodiments may assist in meeting the timing requirements of the handover proceedings even in a handover between nodes that are designed based on different standards and/or specifications.

30 Brief Description of Drawings

For better understanding of the present invention, reference will now be made by way of example to the accompanying drawings in which:

Figure 1 shows a network arrangement where the 5 embodiments of the present invention may be implemented;

Figure 2 discloses in more detail a dual-mode network arrangement; and

Figure 3 is a flowchart illustrating the operation of one embodiment of the present invention.

10

Description of Preferred Embodiments of the Invention

Reference is made to Figure 1 which is a block diagram illustrating a context in which the present invention may be used. That is, a cellular telecommunication system providing both packet switched service and circuit switched services for user equipment. More particularly, Figure 1 illustrates a mobile communication system that allows a plurality of mobile stations MS1, MS2, MS3 to communicate with base (transceiver) stations in via respective wireless connections. Each base station has a radio transceiver capable of transmitting radio signals in downlink to the mobile stations within the cell area and receiving radio signals in uplink from the cell area next to the base station. By means of these signals the base station can communicate with the mobile station (MS) in that cell, which itself includes a radio transceiver.

The base stations of the UMTS may be called to as node B, and thus this term is to be used, for clarity reasons, in the 30 following to distinguish them from the GSM base stations BTS. The mobile stations may have a connection either to the base station BTS or to the Node B. It should be appreciated that

the functions of the base station BTS and the Node B may also be implemented by means of one entity, i.e. that a base transceiver station may serve both the GSM system and the UMTS system.

5 Data to be transmitted from and to the user equipment, which comprise mobile stations, may be speech data, video data or other data. Any packet data transmission may be encoded into a form suitable for transmission at a bit rate which is 10 dependent on the application and the source of the data.

A base station BTS 30 or Node B 26 is connected to a controller node of the cellular network. Thus, during a connection, a mobile station (MS) is connected to a controller node via the base station or the Node B. Examples 15 of the controller include a base station controller BSC 34, a radio network controller RNC 24 and mobile switching centers MSC 12 and 16 (GSM and UMTS sides, respectively), the operation of which will be explained in more detail below 20 with reference to Figure 2. It should be appreciated that other control nodes may also be used for the implementation of the network control function.

The user equipment UE 6 comprise dual-mode mobile stations 25 that may communicate via the BTS of the GSM system and the Node B of the UMTS system. The location of the mobile station 6 could be fixed (for example if it is providing radio communications for a fixed site) or the MS could be moveable (for example if it is a hand portable transceiver or "mobile 30 phone"). When the mobile station is moveable it may move between cells of the cellular radio system. Therefore, as it moves from one cell (the "old cell"), to another cell (the

"new cell") there is a need to hand it over from communication with the base station and associated network apparatus of the old cell to the base station and associated network apparatus of the new cell without dropping the call.

5 However, it should be appreciated that there may be various other reasons than roaming for the handover, such as overload situations and high priority calls forcing a handover of earlier connections.

10 The packet data service may be a connectionless service where information symbols are transmitted within data packets. The size and length of the data packets may vary. The information symbols are typically carried by means of packet data bearers. The transmission speed of a bearer is defined by a parameter referred to as bitrate. More particularly, bitrate defines the bit rate that has been allocated for a user of the packet data services. Packet data traffic may include various kinds of data transmission, such as short messages or text only emails and transmission of large documents in the 15 background and interactive browsing of the world wide web (WWW).

20 Figure 2 shows in more detail a mobile telephone system structure enabling packet switched PS and circuit switched CS traffic. The main parts of the illustrated mobile telephone system are: a UMTS core network CN 2, a UMTS terrestrial radio access network UTRAN 4, a GSM network, and user equipment UE 6. The core network CN 2 and/or the GSM network can be connected to external networks 8, which can be either 25 Circuit Switched CS networks 81 (e.g. public land mobile network PLMN, public circuit switched network PSTN, integrated services digital network ISDN) or Packet Switched

PS networks 82 (e.g. the TCP/IP protocol Internet). The interface between the core network CN 2 and the UMTS terrestrial radio access network UTRAN 4 is called the Iu interface, and the interface between the UMTS terrestrial radio access network UTRAN 4 and the user equipment UE 6 is called the Uu interface.

The core network CN 2 of Figure 2 is composed of a Home Location Register HLR 10, a Mobile Services Switching Centre/Visitor Location Register MSC/VLR12, a Gateway MSC GMSC 14, a Serving GPRS (General Packet Radio Service) Support Node SGSN 28 and a Gateway GPRS Support Node GGSN 18.

The UTRAN 4 is composed of radio network subsystems RNS 20 and 22. It should be appreciated that more or less than two RNSs may be employed by a UTRAN. The interface between two radio network subsystems RNSs is called the Iur interface. The radio network subsystems RNS 20 and 22 are composed of a radio network controller RNC 24 and one or more node Bs 26. As explained above, the RNC of the UTRAN logically corresponds to the BSC 34 of the GSM (global system for mobile communications) standard. The interface between the radio network controller RNC 24 and node B 26 is called the Iub interface.

The Radio Network Controller RNC 24 is the network element responsible for the control of the radio resources of UTRAN 4. The RNC 24 interfaces the core network CN 2 (normally to one MSC 12 and one SGSN 28) and also terminates the Radio Resource Control RRC protocol that defines the messages and procedures between the user equipment UE 6 and UTRAN 4. The RNC 24 logically corresponds to the base station controller

BSC 34 of the GSM standard. In Figure 2 each radio network controller RNC of the radio access network 4 may be connected to two CN nodes (MSC/VLR and SGSN). However, it should be appreciated that in some network topologies it may be
5 possible that one RNC is connected only to one CN node or to more than two CN nodes.

The main function of the Node B 26 is to perform the air interface L1 (Layer 1) processing (channel coding and interleaving, rate adaptation, spreading, etc). It also performs some basic Radio Resource Management operation such as the inner loop power control. It logically corresponds to the Base Transceiver Station BTS of the GSM standard.

15 The dual-mode mobile station may consist of the Mobile Equipment ME 36, GSM Subscriber Identity Module GSIM 37 and the UMTS Subscriber Identity Module USIM 38. The mobile equipment ME 36 is the radio terminal used for radio communication over the Uu interface between the user equipment UE 6 and the UTRAN 4 and over the interface between UE and the BTS 30. The GSIM 37 and the USIM 38 is typically a smart card that holds the subscriber identity, performs authentication algorithms, and stores authentication and encryption keys and some subscription information that is needed at the terminal. These GSIM and USIM function may be implemented by one or two cards, depending on the application.

In the GSM multiple traffic channels TCHs can be combined to form a high speed data bearer. This is indicated for the network nodes by appropriate parameters (e.g. by a parameter indicating the maximum number of traffic channels) in a

Bearer Capability Information Element BCIE. However, these parameters are not needed in the UMTS call set-up, but the UTRAN function provides data bearers that may be of any size. The UMTS supports only a part of the fields of the BCIE.

- 5 Although the multislot parameters are not needed at the setup of the original UMTS-call between the mobile station 6 and the UMTS MSC 16, they are needed to be able to set-up the connection between the mobile station and the target GSM MSC 12.

10

- The following describes a procedure enabling handover from the MSC 16 of the packet switched UMTS to the MSC 12 of the circuit switched GSM. In the embodiment the GSM side bearer is set-up at a UMTS to GSM handover based on employment of a 15 default set of parameters. The mobile station MS is allowed to modify these parameters after handover. These default parameters may be obtained based on mapping from the UMTS side bearer quality of service (QoS). The default set of parameters specifies e.g. the number of traffic channels 20 which can be calculated from UMTS bitrate. That is, the missing values of the BCIE fields are determined by an appropriate network element. The default parameters may be defined beforehand e.g. by the network operator.

- 25 The handover procedures may be based on a default set of parameters e.g. such that the current bearer attributes are mapped into 'sufficient' values. For example, a 28,8 kbps data bearer in the packet switched network will require three 9.6 kbps traffic channels in the switched network side, and 30 thus maximum_number_traffic_channels parameter is given a value of 3. That is, in the GSM network three traffic

channels are required in order to be able to continue the communication.

5 The determination of the appropriate default values for the parameters may be accomplished by the target MSC 12. It should be appreciated that the determination may also be accomplished by the source MSC 16 i.e. the previous controller or any other appropriate controller element of the communication system.

10

As is shown by Figure 3, a communication path is established between the target MSC 12 and the mobile station 6 after initiation of the handover procedure. Necessary radio resources may be reserved for the connection based on the default parameters that may be based information obtained through the mapping. The actual handover is preferably accomplished only after the required resources are reserved for the communication path between the mobile station and the target MSC 12 via the BSC 34, BTS 12 and wireless interface between the BTS 12 and the mobile station 6. That is, the connection between the mobile station 6 and the MSC 12 is negotiated based on default values before the actual handover procedure.

25 The target GSM MSC may initiate a MODIFY procedure, if this is required to negotiate the assumed multislot parameters with the mobile station. The MODIFY procedure is a feature of the GSM that is used for a new purpose in this embodiment. In other words, the target MSC may send a MODIFY-message which 30 contains a BCIE with the default multislot parameters. This may be done after the actual handover procedure, i.e. when the time factor is not as critical as it is during the

handover. However, the modify procedure may also be accomplished in during the set-up of the connection between the mobile station and the target MSC.

- 5 The mobile station MS may accept the new parameters by responding with a MODIFY_COMPLETE-message with the proposed parameters. In case the mobile station will accept the connection but not the proposed parameters, it may respond with altered parameters. The mobile station MS may also
- 10 reject the connection and the proposed parameters by MODIFY_REJECT in which case the call will be disconnected.

It should be appreciated that whilst embodiments of the present invention have been described in relation to mobile stations, embodiments of the present invention are applicable to any other suitable type of user equipment.

The data is described as being in packet form. In alternative embodiments of the invention the data may be sent in any
20 suitable format.

It should be appreciated that the GSM MSC node and the UMTS MSC node may be implemented within one entity or network node.

25

The embodiment of the invention has discussed handover of a connection between user equipment and a network controller. Embodiments of the present invention may also be applicable to a handover between other network elements where
30 applicable.

The embodiments may make it unnecessary for the dual mode (GSM-UMTS) mobile station to generate and send any GSM-specific parameters at every UMTS-call setup, and therefore it is possible to avoid a procedure that may be unnecessary for the most of the UMTS calls. The embodiments also meet the tight timing requirements of the handover.

It is also noted herein that while the above describes exemplifying embodiments of the invention, there are several variations and modifications which may be made to the disclosed solution without departing from the scope of the present invention as defined in the appended claims.

Claims

1. A method in a communication system that includes a first node; a second node and a third node, comprising the steps
5 of:
 - establishing a connection between the first node and the second node based on predefined parameters;
 - initiating handover procedure of the connection so that the connection may continue between the first node and the
10 third node;
 - using a default value for at least one connection parameter required to establish the connection between the first node and the third node; and
 - modifying, if determined necessary, the value of said at
15 least one parameter.
2. A method as claimed in claim 1, wherein the connection to be handed over is a data connection.
- 20 3. A method as claimed in claim 2, wherein the data connection is a high speed data connection.
4. A method as claimed in any preceding claim, wherein the first node is user equipment.
25
5. A method as claimed in claim 4, wherein the user equipment is a mobile station of a cellular communication system.
- 30 6. A method as claimed in any preceding claim, wherein the second node is a controller of a packet switched communication network.

7. A method as claimed in claim 6, wherein the controller is a radio access network controller.

5 8. A method as claimed in any preceding claim, wherein the third node is a controller of a circuit switched communication network.

9. A method as claimed in claim 8, wherein the controller 10 of the circuit switched communication network is a mobile switching centre.

10. A method as claimed in any preceding claim, wherein the default value of the parameter is based on quality of service 15 parameter of the connection between the first and second nodes.

11. A method as claimed in any preceding claim, wherein said default value of the parameter comprises a parameter 20 indicating the number of traffic channels for a circuit switched connection.

12. A method as claimed in claim 11, wherein said default value for the parameter indicating the number of traffic 25 channels is determined based on the bitrate of a packet switched connection between the first and the second nodes.

13. A method as claimed in claim 10 or 11 or 12, wherein the default value of the parameter is determined by mapping at 30 least one of the bearer characteristics of the connection between the first node and the second node in characteristic of the connection between the first node and the third node.

14. A method as claimed in any of the preceding claims, wherein the step of modifying comprises:

transmitting modify request from the third node to the
5 first node, the request containing bearer capability information and said at least one default parameter;

determining whether the proposed default parameters are acceptable by the first node; and

transmitting a response from the first node to the third
10 node indicating the result of the determination.

15. A method as claimed in claim 14, wherein the response comprises one of the following information:

modification completed acknowledgement together with said at
15 least one default parameter;
modification completed acknowledgement together with at least one parameter that is modified from the default parameter; or
modification rejected announcement.

20 16. A communication system comprising:

a first node, a second node and a third node, wherein the first node may communicate with the second node and the third node and a connection between the first node and the second node can be handed over to a connection between the first node and the third node, the set-up of a connection between the first node and the third node being based on at least one parameter that is different from the parameters required for the set-up of the connection between the first node and the second node;

30 a controller for determining a default value for said at least one different parameter to be used for setting up the

connection between the first node and the third node after the handover procedures have been initiated; and means for modifying the value of said at least one parameter.

5

17. A communication system as claimed in claim 16, wherein the connection to be handed over is a data connection.

10 18. A communication system as claimed in claim 17, wherein the data connection is a high speed data connection.

19. A communication system as claimed in any of claims 16 to 18, wherein the first node is user equipment.

15 20. A communication system as claimed in claim 19, wherein the user equipment is a mobile station of a cellular communication system.

20 21. A communication system as claimed in any of claims 16 to 20, wherein the second node is a controller of a packet switched communication network.

22. A communication system as claimed in claim 21, wherein the controller is a radio access network controller.

25 23. A communication system as claimed in any of claims 16 to 22, wherein the third node is a controller of a circuit switched communication network.

30 24. A communication system as claimed in claim 23, wherein the controller of the circuit switched communication network is a mobile switching centre.

25. A communication system as claimed in any of claims 16 to
24, wherein the default parameter is based on quality of
service parameter of the connection between the first and
5 second nodes.

26. A communication system as claimed in any of claims 16 to
25, wherein said parameter comprises a parameter indicating
the number of traffic channels for a circuit switched
10 connection.

27. A communication system as claimed in claim 26, wherein
the controller is adapted to determine said parameter
indicating the number of traffic channels based on the
15 bitrate of a packet switched connection between the first and
the second nodes.

28. A communication system as claimed in any of claims 16 to
27, wherein the default parameter is determined by mapping at
20 least one of bearer characteristics of the connection between
the first node and the second node in characteristic of the
connection between the first node and the third node.

29. A communication system as claimed in any of claims 16 to
25 28, wherein the third node is adapted to generate and
transmit a modify request to the first node, the request
containing bearer capability information and said at least
one default parameter, and the first node is adapted to
determine whether the proposed default parameters are
30 acceptable and to generate and transmit a response to the
third node indicating the result of the determination.

30. A communication system as claimed in claim 29, wherein the response comprises one of the following information:

modification completed acknowledgement together with said at least one default parameter;

5 modification completed acknowledgement together with at least one parameter that is modified from the default parameter; or

modification rejected announcement.

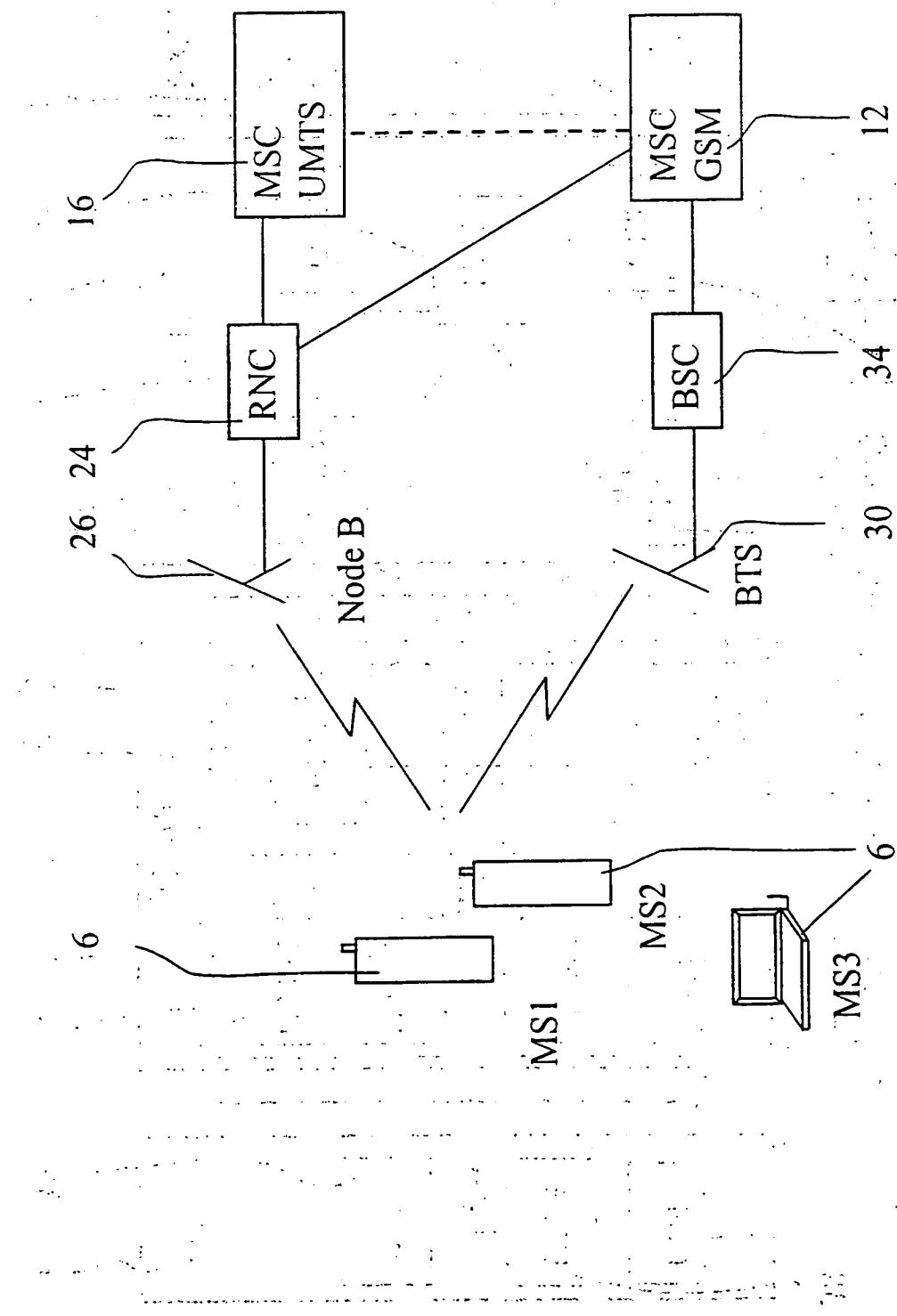


Fig. 1

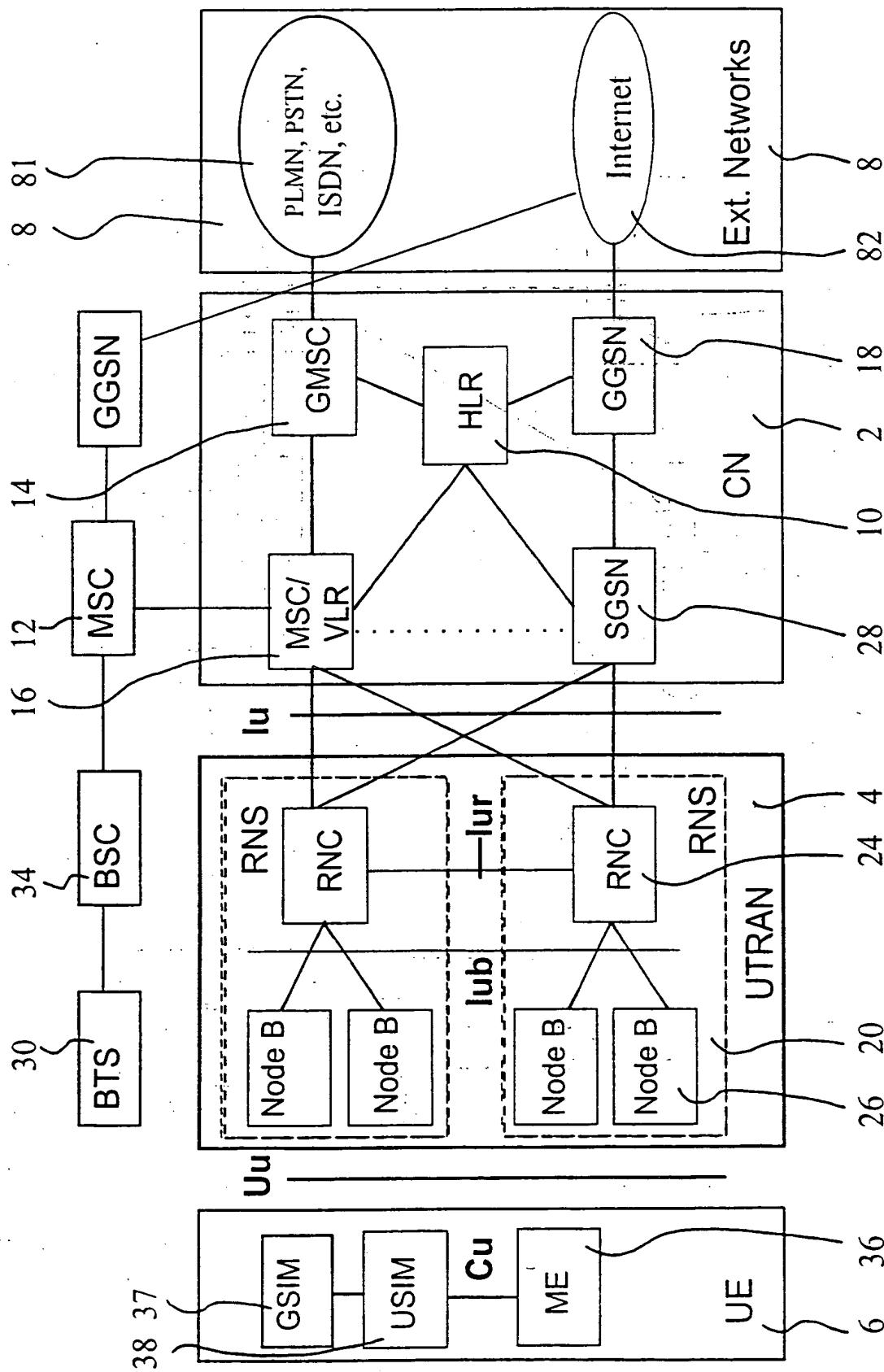


Fig. 2

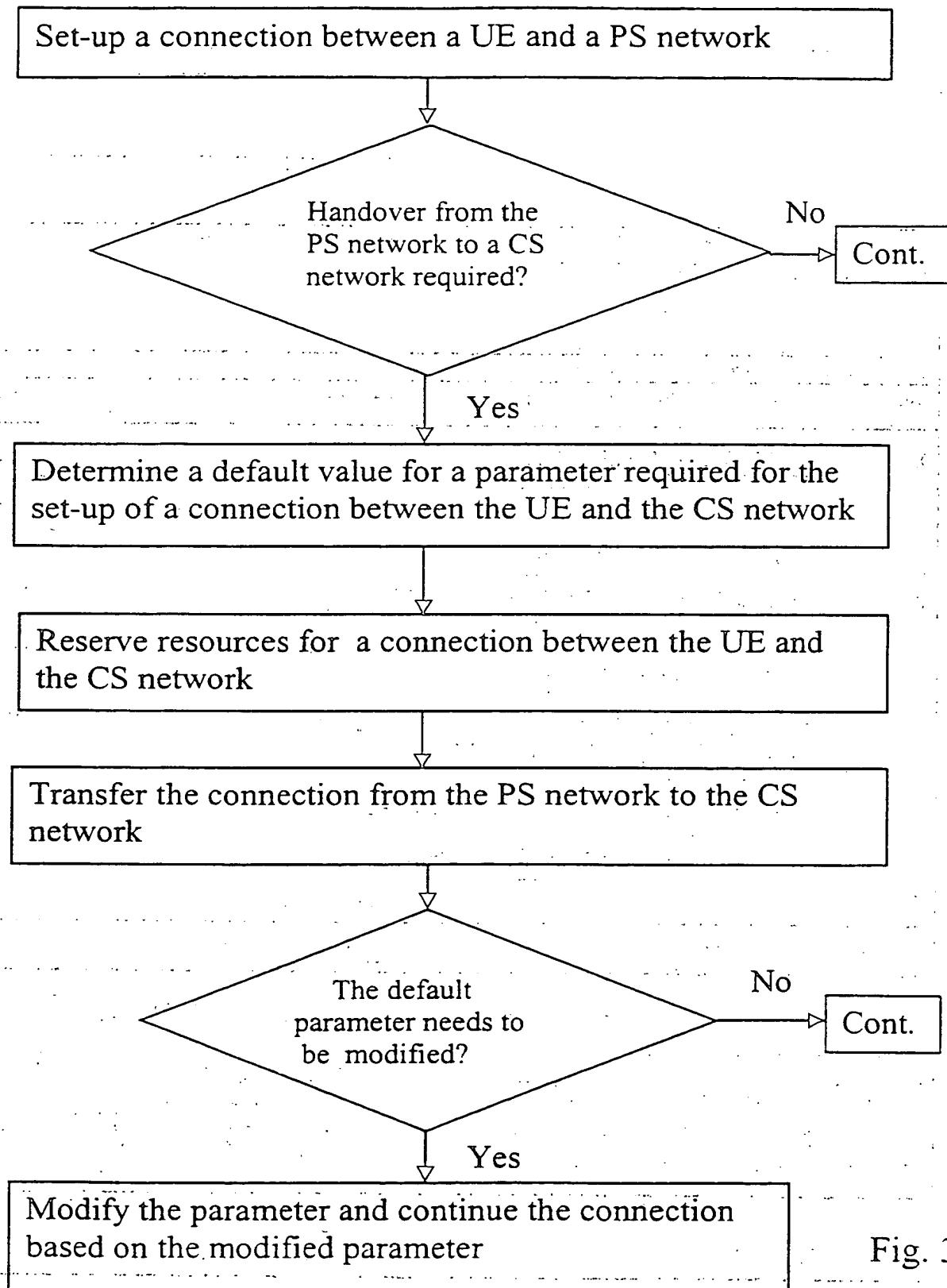


Fig. 3

INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 01/02131

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H04Q7/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 99 35872 A (LE KHIEM) 15 July 1999 (1999-07-15) page 4, line 2 - line 17 page 12, line 1 - line 2	1-5, 8, 9, 16-20, 23, 24
X	GB 2 321 161 A (NEC TECHNOLOGIES) 15 July 1998 (1998-07-15) page 5, line 16 - page 6, line 16	1, 4, 5, 8, 16, 19, 20, 23
A	ETSI: "Handover Requirements between UMTS and GSM or other Radio Systems (3G TS 22.129 version 3.2.0)" TECHNICAL SPECIFICATION, December 1999 (1999-12), pages 1-20, XP002143722 page 12, line 1 - page 14, line 3	1, 16

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

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